PATENT SPECIFICATION (11) 1 420 965

1 420 965

(21) Application No. 57051/72 (22) Filed 11 Dec. 1972 (19)
(31) Convention Application Nos. 7 147 881 (32) Filed 16 Dec. 1971
2 165 286 23 Dec. 1971 in
(33) Germany (DT)
(44) Complete Specification published 14 Jan. 1976
(51) INT. CL.² F16H 1/36
(52) Index at acceptance
F2Q 7A3C1E 7A3C2A 7A3C3

(54) IMPROVEMENTS IN OR RELATING TO MULTISTAGE REDUCTION GEARS

(71) We, LOHMANN & STOLTERFOHT AKTIENGESELLSCHAFT, a German Company, of 581 Witten/Ruhr, Mannesmannstrasse 29, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to multistage reduction gears.

According to the present invention there is provided a multistage reduction gear comprising two in-line epicyclic gear stages and at least one preceding simple reduction gear stage having a transmission path extending from a gear of a preliminary simple stage, via a large gear of the preliminary stage, next via a central gear of an intermediate epicyclic stage next via planet wheels and a planet carrier of the intermediate stage, next via a central gear of an output epicyclic stage, to planet wheels and a planet carrier of the output stage, wherein the central gear of the output stage is resiliently mounted at the output side in a hollow shaft which is either rigidly connected to or which forms part of the planet carrier of the output stage, in such manner that it has limited degree of transverse movement, said resilient mounting being effected by resilient elements whose restoring forces are sufficient to substantially centralise the central gear when it is unloaded, wherein the central gear of the output stage is not carried in bearings at the drive side but is rigidly attached to the planet carrier of the intermediate stage, wherein the planet carrier of the intermediate stage is not carried in bearings at the output side and in such manner at the drive side that it can move pendulously, and wherein the central gear of the intermediate stage is not carried in bearings but it attached to the large gear of the preliminary stage in such manner that a degree of angular movement can occur therebetween.

Generally, to provide pendulous support of the intermediate stage planet carrier, at the drive side, it will suffice to use a roller bearing which can deflect within specific limits. The facility for pendulous movement, however, can also, in accordance with a further development of the invention, be achieved, and incidentally coupled with or employed to transmit a transverse facility for movement, in that the bearing comprises resilient elements of the kind used for the centralising of the intermediate gear of the output stage.

An elastic bearing arrangement which is particularly simple and compact, as well as cheap, is produced if the resilient elements comprise a plurality of rubber O-rings which are assembled in a preloaded fashion in an annular chamber surrounding the outer race of a roller bearing carried upon a stub of the central gear.

Through the design of the reduction gear in accordance with the invention, the result is generally achieved that both epicyclic gear stages possess load compensation, those parts of the two epicyclic gear stages which are able to perform a transverse movement, being connected together. Thus, generally a resilient bearing will be economised on because with separate resilient bearing arrangements in the epicyclic gear stages, at least one resilient bearing and one bearing a pendulous degree of freedom, or again two resilient bearings, would have been needed hitherto in each stage, and in specific applications it would also be necessary to provide for angular motion in the connection between the central gear of the output stage in the planet carrier of the intermediate stage.

The design of the reduction gear in accordance with the invention, thus, at the expense of very small constructional outlay, generally speaking, provides optimum load compensation of the two epicyclic gear changes. The use of elastic elements which enables the weight of the sprung component to be supported so that these latter are substantially always centralised, is largely responsible for ensuring proper engagement of the toothed components, thereby reducing

pendulous fashion at the drive side by means of resilient elements of substantially the same kind as are used to centralise the central gear in the output stage.

3. A multistage reduction gear as claimed in Claim 1 or Claim 2, wherein the resilient elements comprise a plurality of rubber O-rings which are assembled in a preloaded fashion in an annular chamber surrounding the outer race of a roller bearing carried upon a stub of the central gear.

4. A multistage reduction gear substantially as herein described with reference to Figure 1 and Figure 2 or Figure 3 and Figure 2 of the drawings.

For the Applicants,
G. F. REDFERN & CO.,
St. Martin's House, 177 Preston Road,
Brighton, Sussex,
and
Southampton House,
317 High Holborn,
London, W.C.1.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1976.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1420965 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

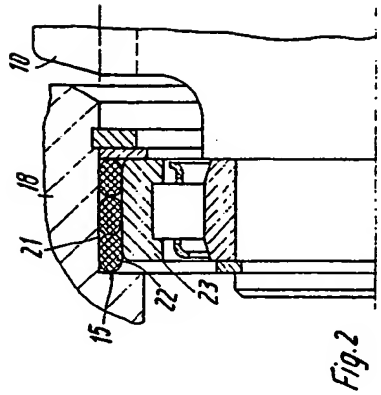

Fig.2

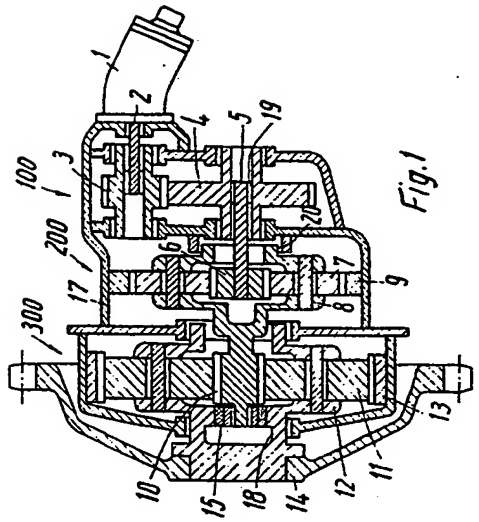

Fig.1

1420965 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

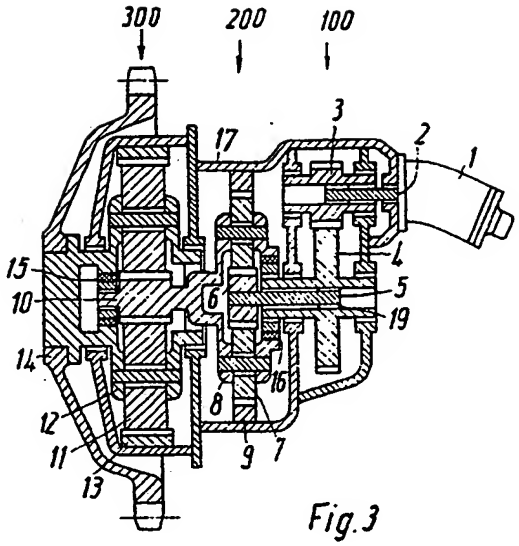

Fig.3